CHEMICAL BONDING

1. INTRODUCTION

(i) It is well known fact that except for inert gases , no other element exists as independent atoms under ordinary condition.

(ii) Most of the elements exist as molecules which are cluster of atoms. How do atoms combine to form molecules and why do atoms form bonds ? Such doubts will be discussed in this chapter.(iii) A molecule will only be formed if it is more stable and has a lower energy, than the individual atoms.

2. CHEMICAL BOND

- (i) A force that acts between two or more atoms to hold them together as a stable molecule.
- (ii) It is union of two or more atoms involving redistribution of e^- among them.
- (iii) This process accompanied by decrease in energy.
- (iv) Decrease in energy \propto Strength of the bond.
- (v) Therefore molecules are more stable than atoms.

3. CAUSE OF CHEMICAL COMBINATION

1. Tendency to acquire minimum energy :

(i) When two atoms approaches to each other. Nucleus of one atom attracts the electron of another atom.

(ii) Two nuclei and electron of both the atoms repells each other.

(iii) If net result is attraction, the total energy of the system (molecule) decreases and a chemical bond forms.

- (iv) So Attraction I 1/energy I Stability.
- 2. Tendency to acquire noble gas configuration :
- (i) Atom combines to acquire noble gas configuration.
- (ii) Only outermost electron i.e. ns, np and (n-1)d electrons participate in bond formation.
- (iii) Inert gas elements do not participate, as they have stable electronic configuration and hence minimum energy. (Stable configuration $1s^2$ or ns^2np^6)
- Ex.1 When two atoms combine to form a molecule -
 - (A) Energy is released (B) Energy is absorbed
 - (C) Energy is neither released nor absorbed (D) Energy may either released or absorbed
- Sol. (A) To attain stability energy is released.

4. LEWIS OCTET RULE

- (i) Every atom has a tendency to complete its octet outermost.
- (ii) H has the tendency to complete its duplet.
- (iii) To acquire inert gas configuration atoms loose or gain electron or share electron.

(iv) The tendency of atoms to achieve eight electrons in their outer most shell is known as Lewis octet rule.





Obeys octet rule

Doesn't obeys octet rule

(v) In the formation of a molecule, only the outer shell electron are involved and they are known as valence

electron.

(vi) The outer shell electrons are shown as dots surrounding the symbol of the atom. These symbols are known as lewis symbols or electron dot symbols. These symbols ignore the inner shell electrons.







electrovalency of Ca = 2electrovalency of O = 2

(vii) The force of attraction is equal in all direction so ionic bond is non-directional.(viii) Ionic compound do not have molecular formula. It has only empirical formula. eg. NaCl is empirical formula of sodium chloride.

- Ex.4 Ions are formed from neutral atoms by -
 - (A) Loss of electron
 - (C) Sharing of electrons

- (B) Gain of electrons
- (D) Loss and gain of electrons

Sol. (D) Cation and anion are formed by losing and sharing of electrons respectively.

6. COVALENT BOND

(I) A covalent bond is formed by the mutual sharing of electrons between two atoms of electro negative elements to complete their octet. (Except H which completes its duplet).



(ii) The shared pair of electrons should have opposite spins, and are localised between two atoms concerned.

(iii) Shairing of electrons may occurs in three ways -

No. of electrons shared between two atoms	Electron pair	Bond
2	1	Single bond (—)
4	2	Double bond 🖨
6	3	Triple bond 🖨

Examples – H-N-H Three single bonds (not triplet bond)

 $N \equiv N$ Triple bond. (not three bond) O = O Double bond (Not two single bond) H = O = H (Two single bonds.)

Lewis structure and covalent bond :

(i) Electron dot structures, also known as Lewis structures of covalent molecules, are written in accordance with octet rule.

(ii) All atoms in a formula will have a total of eight electrons by sharing in the valence shell except the H-atom which forms the largest number of bonds with other atoms placed in the centre of skeleton structure. Other atoms surrounds it to complete the octet.



	EXERCISE			
Q.1	 When two atoms combine to form a molecules: (A) Energy is released (B) Energy is absorbed (C) Energy is neither released nor absorbed (D) Energy may either released or aborbed 	Q.7	Element X is strongly electropositive and is strongly electronegative. Both are univalent. The compound formed would be: (A) $X^+ Y^-$ (B) $X - Y$ (C) $X^- Y^+$ (D) $X \rightarrow Y$	
Q.2	The combination of atoms occur because they want : (A) To decrease number of electrons in the outer most orbit (B) To attain an inert gas configuration (C) To increase number of electrons in the outer most orbit (D) To attain 18 electrons in the outermost orbit	Q.8	 Element a has 3 electrons in the outermost orbit and element B has 6 eletrons in the outermost orbit. The formula of the compound formed between A and B would be: (A) High melting points and non-directional bonds (B) High melting points and low boiling points (C) Directional bonds and low boiling points (D) High solubilities in polar and non-polar 	
Q.3	 Which condition favours the bond formation: (A) Maximum attraction and maximum potential energy (B) Minimum attraction and minimum potential energy (C) Minimum potential energy and maximum attraction (D) None of the above 	Q.9	 point Ionic compounds in general possess both: (A) High melting points and non-directional bonds (B) High melting points and low boiling points (C) Directional bonds and low boiling points (D) Ligh calubilities in paler and paper polar. 	
Q.4	 an electrovalent bond or ionic bond is formed between: (A) Two electronegative atoms (B) Two metals (C) Electropositive and electronegative atoms (D) Two electropositive atoms 	Q.10	 (D) High solubilities in polar and hon-polar solvents Conditions for ionic bond formation is/are: (1) Small cation, large anion (2) low IP of cation, high electron affinity of anion (3) Large cation, small anion and less 	
Q.5	Most favourable conditions for electrovalent bonding are: (A) Low ionisation potential of one atom and high electron affinity of the other atom (B) High electron affinity and high ionisation potential of both the atoms (C) low electron affinity and low ionisation potential of both the atoms (D) High ionisation potential of one atom and low electrons afinity of the other atom	Q.11	 charge (4) Less lattice energy Correct answer is: (A) 1, 4 (B) 2, 3 and 4 (C) 2 and 3 (D) 1, 2 Electrovalent compounds or ionic compounds do not show stereoisomerism. The reason is: (A) Presence of ions (B) Strong electro static force of attraction 	
Q.6	Electrovalent bond or ionic bond is formed by: (A) Sharing of electons (B) Donaton of electrons (C) Transfer of electrons (D) None of these	Q.12	(C) Brittleness(D) Non-directional nature of ionic bondCompound of a metal 'M' is M_2O_3 . The formulaof its nitride will be:(A) M_3N (B) MN(C) M_3N_2 (D) M_2N_3	
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